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Results of Validity and Practicality Test of ICT-Science Learning Material with Learning Cycle Model for Improving Digital Literacy of Students

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Abstract—The era of industrial revolution 4.0 made a significant impact on various aspects including the world of education. One of these influences is the existence of ICT-based learning material. ICT-based learning material can make learning more effective, interesting, and meaningful. Also, in the era of the 4.0 industrial revolution, a variety of skills must be possessed by someone. However, the real conditions show that the existing science learning material are still lacking to form someone who has skills by the demands of the 4.0 revolution era. An alternative solution to this problem is to develop ICT-science learning material with learning cycle model for improving digital literacy of students. This type of research is development research. The development model used is the ADDIE model which stands for analyze, design, develop, implement, and evaluate. The instruments used to collect data consisted of validity sheets and practicality sheets given to teachers and students. The data analysis technique used descriptive statistical analysis. Based on the data analysis, two research results were obtained. First, the test results of the validity of ICT-science learning material with learning cycle model are in the very well category with an average value of 91.29. Based on these results it can be indicated that the ICT-science learning material with learning cycle model are valid. Second, the practical results of ICT-science learning material with learning cycle model according to the teacher and students are in the very well category with average scores of 92.08 and 80.69. This indicates that ICT-science learning material with learning cycle model can be said to be practical. Thus, it can be concluded that ICT-science learning material with learning cycle model for improving digital literacy of students are valid and practical

Keywords —ICT-Science Teaching Material, Learning Cycle Model, Digital Literacy

I. Introduction

The era of the industrial revolution 4.0 requires a variety of skills a person must have. In responding to this, 21st-century learning is carried out. Literacy is one of the skills required for 21st-century learning. Literacy refers to basic skills in a particular field that enable individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and society at large [1].

Science is one of the subjects studied in school. Science can be said to be a branch of basic science that is closely related to technological developments. The study in science is very broad covering nature and its contents. In essence, science is built on scientific products, scientific processes, and scientific attitudes [2] [3]. Through science education, the ability to think critically, logically, systematically can be developed to equip students to be able to face competition.

Science learning is carried out with the concept of Integrated Science (integrative science) which is supported by the use of themes according to the demands of the 2013 curriculum. This integrated concept illustrates that scientific disciplines are no longer visible explicitly and clearly [3] [4]. This is confirmed by the opinion of Asrizal (2018) which states that the science subject must be adjusted to the demands of the 2013 curriculum which requires the concept of integration by integrating the science concept in the sub-disciplines of Biology, Physics, and Chemistry [5]. The integration of science concepts does not mean forming new concepts from the basic concepts of Physics, Chemistry, and Biology. Integrated science learning provides opportunities for students to understand the natural surroundings with more experience [6]. Also, linking learning with environmental situations is very easy if taught in an integrated model using a theme and learning resources for students [7] [42].

The real conditions that occur in the field are still not following the expected ideal conditions. This can be seen from several analyzes that have been carried out, namely: competency analysis, learning material and student digital literacy. First, the science competency analysis for class VIII shows that the competence of knowledge and skills competencies is still not integrated. Second, there is a lack of material integration in the eighth grade science textbooks. This is in line with research conducted by Asrizal (2018) [8]. Third, students digital literacy is still in the low category. This is confirmed by other research which states that the digital literacy of Indonesian society is low [9]. Also, in Indonesia itself, digital literacy is still focused on technically using the internet and many schools that teach Information and Communication Technology (ICT) education only focus on skills in computer operation [10].

Literacy is one of the basic skills that are important for students. Literacy can be defined as the ability to be able to identify, understand, interpret, design, and communicate [12]. With literacy skills, students can interact and socialize with each other and can construct the ideas they have to convey to others.

In this digital era, a person not only needs the ability to read and write but also the ability to master the digital era. One of these abilities is digital literacy. Digital literacy can be defined as the ability of individuals to apply functional skills to digital devices so that they can find and select information, think critically, be creative, collaborate with others, communicate effectively, and still ignore electronic security and the developing socio-cultural context [13]] [14]. Digital literacy consists of eight supporting components, namely: functional skills, creativity, collaboration, effective communication, the ability to find select information, critical thinking, cultural and social understanding, and e-safety [13].

Digital literacy has important benefits for every individual. Even in some cases, digital literacy can affect the performance of an organization. A person can be said to have digital literacy if he has the ability to be able to complete tasks effectively in a digital environment. The ability referred to is the ability to read and interpret media, produce data and images through digital manipulation, and evaluate and create new knowledge obtained from the digital environment [15].

One of the government's efforts to make students who have literacy abilities is with the implementation of the School Literacy Movement (SLM). SLM can be interpreted as a comprehensive effort that involves all school members, be it teachers, students, parents, and the community as part of the education ecosystem [16]. Through SLM, it can grow character and can instill and foster literacy skills in students.

The digital literacy component can be integrated into a science learning material. The use of learning material is a process in learning. Teachers can use learning material to facilitate students to understand learning material. Learning material can be defined as essential and important tools to encourage teacher efficiency in learning and can improve student performance [17] [18]. Also, learning material is an object that helps teachers to present learning in a logical and orderly manner to students [19] [20].

In the learning process, learning teaching material plays an important role [21] [22]. The role of learning material is first, can make learning more interesting, practical, realistic, and meaningful [17] [23]. Second, it can improve learning outcomes, save time, increase student interest, and facilitate student memory [24]. Third, to develop self-confidence, self-actualization, and motivation of students [17] [25]. Besides, the role of learning material can develop the three competencies of students, namely knowledge competencies, skills competencies, and attitude competencies, and can increase values in the learning process [26].

The core activities in the learning process must use models, methods, and learning resources that are tailored to the characteristics of students and subjects. The use of learning material in learning is included in the core activities, so the activities in the learning material should use a learning model syntax that can support the implementation of integrated science learning that is close to the real-world context. One learning model that uses a real-world context or phenomena in life is the 5E learning cycle model [27]. The 5E learning cycle model has stages that make learning interactive through contextual learning for students [28]. The 5E learning cycle model can improve learning achievement and can improve student's critical thinking skills [29]. In addition, the 5E learning cycle model can facilitate learning by understanding the problems of natural phenomena and can build students' critical thinking skills [30].

The times demand the use of Information and Communication Technology (ICT) in all aspects including in the design of teaching materials. ICT-based learning material. Is a learning material that is compiled and developed using ICT tools in processing data, processing, obtaining, compiling, storing, manipulating data in various ways to produce quality information. The use of ICT learning material allows students to learn a basic competency in a coherent, systematic, interactive, and innovative manner so that all competencies are expected to be achieved in an integrated manner. One of the benefits of ICT in learning is to make learning material more attractive [31]. ICT-based learning materials have the advantage of being more attractive to students because learning material can contain sound, images, or animation [11].

ICT-based science learning material has been carried out by several previous researchers. Research from ICT-based science learning material shows that the learning material is suitable for use in the science learning process [40]. Apart from that, other studies have produced an integrated science learning material design integrating ICT-based character values [41]. Based on the results of previous research, there are several differences with the research conducted. First, the ICT-based science learning material developed to integrate the 5E learning cycle model are teaching materials that integrate the model. Second, ICT-based science learning material developed contains three components of digital literacy, namely: critical thinking, creativity, and effective communication. Each component of digital literacy will provide opportunities for students to explore themselves to think critically, creatively, and communicate effectively. In addition, the use of the 5E learning cycle model can guide and encourage students to improve their thinking patterns.

ICT-based science material developed has several advantages. First, the learning material are more interesting because they are supported by videos and animations. Second, this learning material can optimize the implementation in the learning process because it is not limited to time and place. Third, it helps with more focused learning. Fourth, students will have the ability to think critically, creatively, and effectively in communicating. So that the purpose of this study is to see the results of the validity and practicality of the integrated ICT- science learning material learning cycle model to improve the digital literacy of eighth-grade students of SMP.

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II. METHODS

This type of research is development research using the ADDIE model. The ADDIE model is an iterative instructional design process, where the results of the formative evaluation of each phase can lead the instructional designer back to the previous phase [32]. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation [33] [34] In this paper, what is explained is the validity and practicality of learning material.

Product validation is carried out using a validity sheet consisting of four assessment components, namely: material substance, learning design, visual communication, and software utilization. The validity sheet was given to four Physics lecturers of the State University of Padang. After obtaining the validity results from the experts, revisions were made based on the suggestions of the validator.

The practicality of the product is obtained after conducting trials of the ICT-science learning material with a learning cycle model. Practicality testing was carried out on science teachers and students of SMPN 8 Padang. The practicality of science learning material was tested using a questionnaire sheet on the practicality test. The four components to measure the practicality of a product are usable, easy to use, attractive, and efficient. Each of these components is translated into several more specific indicators with the aim of making it easier to analyze the advantages and disadvantages of ICT-science learning material with the learning cycle model that has been made.

The validity and practicality questionnaire sheet use a modified Likert scale with four alternative answers. The alternative answers are 4 = strongly agree, 3 = agree, 2 = disagree and 1 = strongly disagree. The data analysis technique used for the assessment of validity and practicality was using descriptive statistics. Descriptive analysis is displayed in graphical form so that researchers can determine the average value. The categories used to determine the validity and practicality of ICT-science learning material with a learning cycle model are shown in Table 1 [35].

Table 1. Categories of Validity and Practicality

Intervals	Category
30 – 39	Failed
40 – 55	Less
56 – 65	Enough
66 – 80	Good
81 – 100	Very good

III. Result And Discussion

In general, the results of this study consist of two groups, namely the results of the validity and practicality tests. These two test results are used as the basis for revising the development of ICT-based science learning material with a learning cycle model. The results of the validity and practicality tests are described as follows.

The results of the validity test were obtained from the validity sheet instrument which was filled in by four experts, namely the physics lecturers of FMIPA UNP. On the validity sheet, there are four components of the assessment, namely: the feasibility of material substance (MS), learning design (LD), visual communication (VC), and software utilization (SU).

First, the feasibility of the material substance. In this component, there are seven assessment indicators, namely: the correctness of the substance of the learning material; digital literacy steps and components integrated into learning material; completeness of material coverage; material on learning material can bring up new things; material based on real conditions; the language used is easy to understand and uses standard language. The acquisition value of the material substance component ranges from 81.25 to 93.75. The value of 81.25 is obtained from the material indicators in learning material that can bring up new things. A value of 93.75 is obtained on the indicator of the truth of the material substance in learning material, steps and components of integrated digital literacy in learning material, completeness of material coverage, and using standard language. The average value of the feasibility component of the material substance is 90.18. This illustrates that the feasibility component of the material substance of ICT-science learning material with the learning cycle model is in a very good category.

Second, the feasibility of learning designs related to the components of the learning material. In this component there are eight assessment indicators, namely: suitability (title, class, and semester) of learning material; learning material containing the identity of the compiler; includes SK-KD; indicators in learning material show markers of achievement; suitability of material with KI, KD, and indicators; practice questions can stimulate students to develop knowledge; competency test on learning material allows students to master the competence and suitability of the list of references. The value of the feasibility component of the learning design is in the range of 81.25 to 100.00. The value of 81.25 is obtained from the indicators of question practice which can stimulate students to develop knowledge and competency testing of learning material enables students to master competencies. The value of 100.00 is obtained from the suitability indicator (title, class, and semester) on learning material; learning material containing the identity of the compiler; includes SK-KD and suitability list of references. Overall, the feasibility component of the learning design has an average value of 92.19. Then it can be indicated that the feasibility component of the learning design is in the very good category.

Third, the feasibility of visual communication is related to the appearance of the learning material being developed. In this component, there are eight assessment indicators, namely: ease of navigation for access between slides; font display; function of the media; inclusion of sources from the media; attractiveness of images and videos; color composition; the suitability of animation with the material and the layout of the learning material design. The scores on the feasibility of visual communication components ranged from 87.50 to 100.00. Of the eight indicators, only one indicator got a value of 100.00, namely the indicator of the suitability of the animation with the material. The other seven indicators got a value of 87.50. The average value of the visual communication feasibility component is 89.06 with a very good category.

Fourth, the use of the software is related to the use of software in developing learning material. In this component, there are five assessment indicators, namely: enabling interaction in the learning process; use of good Microsoft Word support software; use of good PowerPoint support software; good use of flip pdf corporate edition supporting software and authenticity of science learning material. In the component of software utilization, the values obtained ranged from 87.50 to 100.00. The value of 87.50 is obtained from the indicators of using good PowerPoint supporting software and using good support software for flip pdf corporate edition. Meanwhile, the value of 100.00 is obtained from the indicators that allow interaction in the learning process and the use of supporting software for Microsoft Word. The average value of the software utilization component was 93.75 with a very good category.

From the four components of the validity of ICT-science learning material with the learning cycle model, the average value for each component was obtained. The average value of the components of the feasibility of material substance, learning design, visual communication, and software utilization is 90.18; 92.19; 89.06, and 93.75. The results of the plot of the average value of each component can be seen in Figure 1.

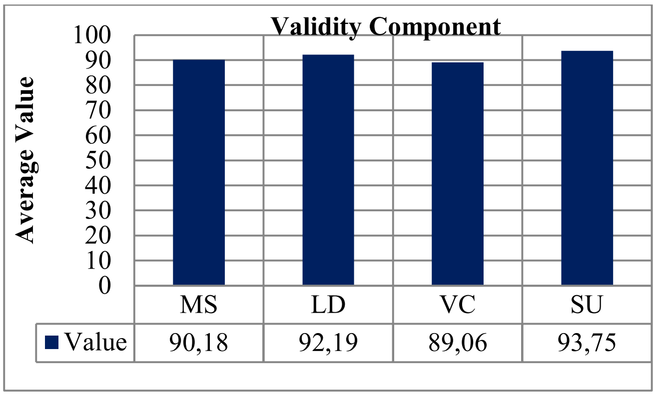

Figure 1. Average Value of Validity Component

Based on Figure 1, it can be concluded that the average value of each validity component ranges from 89.06 to 93.75. This shows that the validity of the components of the feasibility of material substance, learning design, visual communication, and the use of ICT-science learning material software with the learning cycle models are in a very good category. After analyzing each component value, the mean value of the validity of ICT-science learning material with the learning cycle model is 91.29. Based on this average value, it can be concluded that the ICT-science learning material with learning cycle models is already valid in the very good category, but still require revision. One of the objectives of the revision is so that the material on ICT- science learning material with the learning cycle model can be presented better. Learning material should be arranged systematically starting from simple material to more complex material [36]. The revision is adjusted to the suggestions and comments provided by the validator as an expert. With the revision, an ICT-science learning material will be obtained with a well-integrated learning cycle model so that its practicality and effectiveness can be tested [37].

After getting a valid product, the next step is to do a practicality test. The practicality test is divided into two, namely: practicality according to the teacher and practicality according to students. The teachers involved in this assessment were two science teachers at SMPN 8 Padang. The number of students involved in the assessment of ICT-science learning material with the learning cycle model was 29 students of eighth-grade at SMPN 8 Padang.

The practicality test results according to the teacher were obtained from the practicality instruments given to the teacher. The practicality test instrument according to the teacher consists of four components, namely: usable (US), easy to use (EU), attractive (AC), and efficient (EF). In each component, there are several assessment indicators related to teacher responses to ICT-science learning material with the learning cycle model.

The first component of practicality is usability. In this component, there are six assessment indicators, namely: helping to achieve learning objectives; accelerate the learning process; increase the productivity of learning activities; guiding learning activities; used to apply integrated science material and can be used as a source of student learning. The usable component values range from 75.00 to 100.00. The value of 75.00 is obtained from the indicator of accelerating the learning process. The value of 100.00 is obtained from indicators that help achieve learning objectives and are used to apply integrated science material. The mean value of the usable components is 89.58. Thus the data indicated that the practicality of ICT-science learning material with the learning cycle model component could be used very good.

The second component is easy to use. This component consists of five indicators, namely: easy to use in the learning process; make it easier for teachers to master the material; make it easier for teachers to deliver material; make it easier for teachers to activate students and make it easier for teachers to improve student skills. The range of values for the easy-to-use component is 87.50 to 100.00. The value of 87.50 is obtained from the indicators that make it easier for teachers to activate students and make it easier for teachers to improve student skills. The value of 100.00 is obtained from indicators that are easy to use in the learning process, making it easier for teachers to master the material and making it easier for teachers to deliver the material. The average value of the easy-to-use component is 95.00. This indicates that the practicality of ICT-science learning material with the learning cycle model component can be used very good.

The third component is attractive. In this component there are five assessment indicators, namely: cover display; display of learning material content; illustrations of images, videos, and text; packaging learning material and help attract student's attention. The range of scores for the interesting components is 75.00 to 100. The value of 75.00 is obtained from the indicators for illustrating images, videos, and text.

The value of 100.00 is obtained from the cover display indicator and the content display of the learning material. Based on these values, the average value of the attractiveness component is 90.00. Thus it can be indicated that the practicality of ICT-science learning material with the learning cycle model of attractive components is very good.

The fourth component of practicality is efficiency. In this component, there are four assessment indicators, namely: time efficiency in studying the material; teacher time efficiency in the learning process; low cost of preparation and helps teachers control learning. These four indicators have a value range of 87.50 to 100.00. The value of 87.50 is obtained from the indicator of teacher time efficiency in the learning process and the low cost of preparation. The value of 100.00 is obtained from the indicator of time efficiency in studying the material and helping teachers control learning. The average value of these four indicators is 93.75. Thus it can be indicated that the practicality of ICT-science learning material with the learning cycle component of the efficient model is very good.

Analysis of the average value of the practicality assessment of ICT-science learning material with the learning cycle model according to the teacher is determined from each component value. The mean score of usable, user-friendly, attractive, and efficient components was 89.58 respectively; 95.00; 90.00, and 93.75. The results of the plot of the average value of each component can be seen in Figure 2.

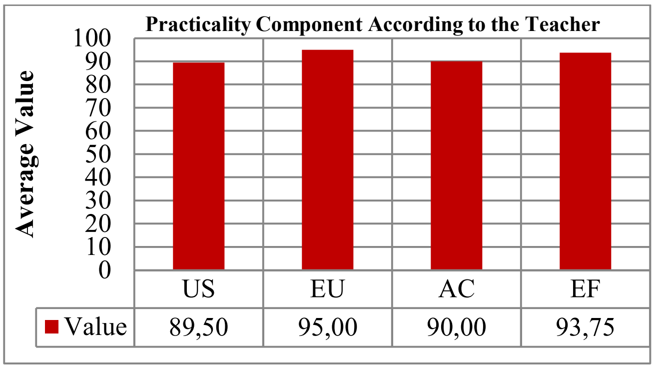

Figure 2. Average Value of Component of Practicality According to the Teacher

Based on Figure 2, it can be stated that the average value of each practicality component according to the teacher ranges from 89.50 to 95.00. After analyzing each component value, the practical average value of ICT-science learning material with the learning cycle model according to the teacher is 92.08. Based on this average value, it can be indicated that the practicality of ICT-science learning material with the learning cycle model according to the teacher is very good.

Next is the practicality test according to the students. The practicality test results were obtained from the practicality instruments given to students. The practicality test instrument according to students consists of four components, namely: usable (US), easy to use (EU), attractive (AC), and efficient (EF). In each component, there are several assessment indicators related to student responses to ICT-science learning material with the learning cycle model.

The first component of practicality is usability. This component has ten assessment indicators, namely: helping to achieve learning objectives; make it easier to understand learning; a sense of curiosity; help in asking questions; prove the correctness of the provisional answer; can be used in finding concepts in science; useful in understanding learning material; can control learning; make active in the discussion and assist in formulating conclusions. The usable component values range from 76.72 to 81.90. The value of 76.72 is obtained from indicators that can control learning. The value of 81.90 is obtained from the indicator proving the truth of the temporary answer. Based on the analysis, the mean value of the usable components is 79.66. Thus the data indicated that the practicality of ICT-science learning material with the learning cycle component model can be used is good.

The second component is easy to use. In this component, there are eight indicators, namely: making it easier to understand the material; the material is easy to understand; easy to understand the phenomena that exist in learning material; questions can require critical, creative and communicative thinking; makes it easy to find science concepts; exercises and competency tests are easy to understand; learning material use language that is easy to understand and makes it easier to control learning activities. The range of values for the easy-to-use component is 75.00 to 82.76. The value of 75.00 is obtained from indicators that make it easier to control learning activities. The value of 82.76 is obtained from the indicators that the questions can demand to think critically, creatively, and communicatively. The average value of the easy-to-use component is 78.56. This indicates that the practicality of ICT- science learning material with the learning cycle model component can be used is a good category.

The third component is attractive. In this component there are seven assessment indicators, namely: cover display; display of teaching material content; image, video, and text illustrations; teaching material packaging; interest in using learning material and increasing knowledge, insight, and information. The range of values for the attractive component was 84.48 to 88.79. The value of 84.48 is obtained from the indicator of learning material packaging; interest in using learning material and increasing knowledge, insight, and information. The value of 88.79 was obtained from the indicator of the content display of learning material. Based on these values, the average value of the attractiveness component is 86.08. Thus it can be indicated that the practicality of ICT-science learning material with the learning cycle model of attractive components is very good.

The fourth component of practicality is efficiency. In this component, there are two assessment indicators, namely: time efficiency in understanding learning material and efficiency in encouraging independent learning. These two indicators have a value of 86.21 and 76.09. The average value of the two indicators of the efficiency component is 78.45. Thus it can be indicated that the practicality of ICT-science learning material with the learning cycle component of the efficient model is good.

Analysis of the average value of the practicality assessment of ICT- science learning material with the learning cycle model is determined from each component value. The mean score of usable, easy to use, attractive, and efficient components was 79.66; 78.56; 86.08, and 78.45. The results of the plot of the average value of each component can be seen in Figure 3.

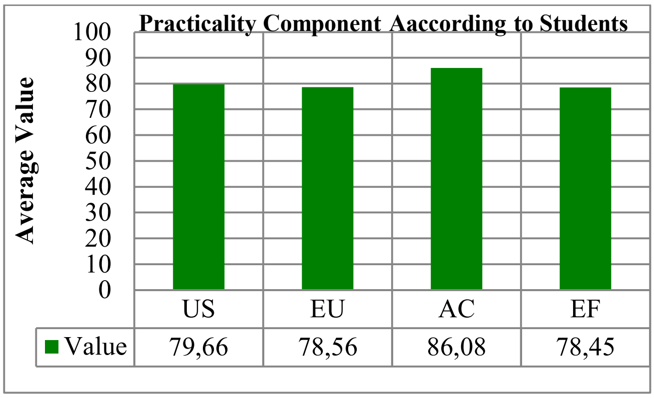

Figure 3. Average Value of Component of Practicality According to Students

Based on Figure 3, it can be concluded that the average value of each practicality component according to students ranges from 78.45 to 86.08. After analyzing each component value, the practical average value of ICT-science learning material with the learning cycle model according to students is 80.69. Based on this average value, it can be indicated that the practicality of ICT-science learning material with the learning cycle model according to the students is very good.

Based on the research results, it can be seen that the ICT-science learning material with the learning cycle model can be declared valid. In other words, the product developed is correct and valid. Besides, it is based on teacher and student assessments that the ICT-science learning material with the learning cycle models are practical. A product can be said that the cost used is not too high, easy to administer, easy to assess, easy to interpret, and the time used is not too long [44]. The use of ICT-science learning material with the learning cycle model in learning activities becomes more practical because it pays attention to the principles of properly structuring learning material. Learning materials contain learning materials that must be mastered by students and the materials are arranged practically and interestingly [38]. In learning materials, there is a detailed explanation of the learning material followed by concrete examples, the description can be supported by the presence of interesting pictures, charts, or graphs [39]. The presentation of interesting learning material can make learning meaningful for students [43]. So that students can develop their abilities and skills [19].

IV. Conclusion

Based on the research that has been done, there are two important conclusions from this study. First, the validity of ICT-science learning material with the learning cycle model can be said to be very good with an average value of 91.29. Second, the practicality of ICT-science learning material with the learning cycle model according to teachers and students is 92.08 and 80.69. This indicates that the practicality of ICT-science learning material with the learning cycle model according to teachers and students can be said to be very good. Thus it can be concluded that the validity of ICT-science learning material with the learning cycle model for improving the digital literacy of eighth-grade students of SMP is valid and practical.

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